FINAL REPORT

JULY 1, 2007 – JUNE 30, 2010

A. PROJECT INFORMATION

Project Title: Fertilizer Education Equals Clean Water

CDFA Contract Number: 07-0120

Project Leaders:

Kay Mercer
Coordinator
S. San Luis Obispo and Santa Barbara Counties
Agricultural Watershed Coalition
P.O. Box 1440
Santa Maria CA 93446
(805) 928-6301 office
(805) 208-8039 cell
Sbagcoalition@verizon.net

Kevin Peterson
Acting District Manager
Cachuma Resource Conservation District
USDA Service Center
920 East Stowell Rd
Santa Maria, CA 93454
(805) 928-9269 x106
kevin.peterson@ca.nacdnet.net

Cooperators:

Mark Gaskell
Farm Advisor
University of California Cooperative Extensive
1256 Sierra Way, Suite C
San Luis Obispo CA 93401
(805) 934-6240
mlgaskell@ucdavis.edu

Tim Hartz
Department of Plant Sciences
UCCE Specialist
University of California
Davis CA 93616
(530) 752-1738
thartz@ucdavis.edu

Mary Degroat
Public Relations Director
Strawberry Commission
P.O. Box 269
Watsonville, CA 95077
(831) 724-1301
mdegroat@calstrawberry.org

Mark Bolda
Farm Advisor, Strawberries
Santa Cruz, Monterey Counties
1432 Freedom Blvd
Watsonville, CA 95076-2796
(831) 763-8040
mpbolda@ucdavis.edu

Will Harrison
Agronomist
Sunrise Growers
701 W Kimberly

James Dana
Production Development Manager
Western Farm Service
P.O. Box 5548

Placentia CA 92870
(949) 559-0312
wharriso@sunrisegrowers.com

Santa Maria CA 93456
(805) 349-9720 x126
jimdana@silcom.com

John Bechtold
District Conservationist
Natural Resources Conservation Service
USDA Service Center
920 E Stowell Rd
Santa Maria CA 93454
(805) 928-9269 x105
john.bechtold@ca.usda.gov

B. STATEMENT OF OBJECTIVES

The primary goal of this project was to provide applicable nitrate and irrigation management practice information to three sub-groups of the Hispanic grower population in the Santa Maria Valley through a multi-level approach that was customized to address different sets of educational needs and to overcome various learning barriers. Irrigation management practices were discussed in the context of their importance to managing nitrate movement.

C. ABSTRACT

The "Fertilizer Education Equals Clean Water" project was designed to provide nitrate and irrigation management practice information to three subgroups of Hispanic growers in the Santa Maria Valley. The Cachuma Resource Conservation District (CRCD) implemented the project in collaboration with the Agricultural Watershed Coalition of Southern San Luis Obispo and Santa Barbara Counties, along with the UC Cooperative Extension (UCCE), The California Strawberry Commission, USDA Natural Resources Conservation Service (NRCS), Western Farm Service, and various growers, coolers, packers, and agrochemical dealers. The project was designed with a customized, multi-level approach to address different educational needs and overcome various barriers to learning. The three target Hispanic subgroups are small-acreage tenants, medium-acreage landowners, and managers/foremen for larger producers. The project consisted primarily of participation in twelve workshops and seven "farm-off" research trials. To help the CRCD to understand how to best meet the challenges of program delivery to the three subgroups of growers, an extensive grower survey was conducted. In the course of the project, CRCD field technicians visited 74 different farmers from all three subgroups to assist growers with soil sampling, interpreting soil analysis reports and in performing the Soil Nitrate Quick Test. The CRCD set-up 'farm-off' field trials with 5 Spanish-speaking growers to evaluate irrigation distribution uniformity, soil moisture content, soil amendments, soil nitrate and soil salinity. The CRCD mobile irrigation lab conducted irrigation evaluations on 11 different farms covering a total of 821 acres. CRCD staff installed soil moisture monitoring equipment (tensiometers) in 3 sugar-snap pea fields and 2 strawberry fields. Technical staff also assisted the farmers in collecting and interpreting the soil moisture data to be used to assist with irrigation scheduling. The CRCD assisted 14 Spanish-speaking growers to sign up for Environmental Quality Incentives Program (EQIP) contracts with NRCS.

D. INTRODUCTION

As agricultural non-point source regulations increase, all growers need to become better informed about the potential impacts of nutrients, pathogens and pesticides on water quality. Growers can be required to implement management practices to address those constituents. Hispanic growers have demonstrated a greater need for education, since, in the past, these growers have not had the same access to information due to language, knowledge, and cultural barriers.

The purpose of this project was to provide practical and applicable nitrate and irrigation management practice information to Hispanic growers in the Santa Maria Valley through a multi-level approach customized to address different sets of educational needs and to overcome various learning barriers in each sub-group.

Sub-group 1- Tenant Hispanic growers that sublease land from and contract with strawberry coolers - These growers tend to be inexperienced, poorly educated and under-capitalized. Some growers do not read or write English or Spanish. Often, they do not understand fertilizer basics such as what N-P-K mean or how to calculate how much nitrogen they are applying. Seminars for these growers provided very basic fertilizer education.

Sub-group 2- Hispanic growers that operate their own small to medium-scale farms - These growers may own or lease their land. They generally have more farming experience and might be better educated. They are usually bilingual. These growers received technical information relating to slow-released fertilizers, when to use a sidedress application, and nitrogen budgeting.

Sub-group 3- Farm managers/irrigation managers/forepersons that work for large vegetable growing operations. These managers are typically Hispanic, have worked their way up in the organization from field worker positions, may have some education and are probably bilingual. Information for this group was concentrated on nitrogen management relative to water quality data collected by the Conditional Waiver Monitoring Program. The data presented was mid-level in terms of technical sophistication. For instance, these growers were introduced to the Nitrate Hazard Index.

E. WORK DESCRIPTION

Task 1. The project was to consist of 2 to 3 workshops tailored to each sub-group along with field trials and supplemental strawberry fertilizer guides/fact sheets. Subtasks differ slightly by year.

Sub-Group 1

1.1 Collaboration with presenters to take place before each workshop to ensure that content technical level and topics were appropriate to each sub-group and that there was no overlap in program delivery.

1.2 Information to be distilled into supplemental hand-outs (see attachment)

1.3 Educational presentation delivery

1.4 Problem solve

1.5 CRCD and/or NRCS follow-up visit sign-up sheets: goal was to follow-up with 25%

1.6 Field visits to demonstration field sites; Santa Maria fertility fact sheet

Sub-Group 2

1.1 Collaboration with presenters to take place before each workshop to ensure that content technical level and topics were appropriate to each sub-group and that there was no overlap in program delivery. Produce workshops for both strawberry and vegetable growers.
1.2 Educational presentation delivery
1.3 Problem solve
1.4 CRCD and/or NRCS follow-up visit sign-up sheets: goal was to follow-up with 25%
1.5 CRCD and/or NRCS assist growers with nitrogen budgeting
1.6 CRCD and/or NRCS to track fertilizer and water-use reduction
1.7 Perform field visits
1.8 Coalition/CRCD/NRCS to summarize results and publish (see attachment)

Sub-Group 3

1.1 Collaboration with presenters, including UC Specialist Tim Hartz, to take place before each workshop to ensure that content technical level and topics were appropriate to each sub-group and that there was no overlap in program delivery.
1.2 Information to be distilled into supplemental hand-outs.
1.3 Educational worksheets
1.4 Problem solve
1.8 Coalition/CRCD to summarize results of field trials and publish (see attachment).

F. RESULTS, DISCUSSION, AND CONCLUSIONS

CRCD hosted or partnered on a total of 12 workshops, with 4 workshops for each sub-group. All workshops were presented in Spanish or in English with interpretation into Spanish. These 12 workshops had a total of 253 growers in attendance, 49 for sub-group 1, 98 for sub-group 2, and 106 for sub-group 3. 5 workshops were held in year 1 (July 1, 2007 – June 30, 2008), 4 workshops were held in year 2 (July 1, 2008 – June 30, 2009), and 3 workshops were held in year 3 (July 1, 2009 – June 30, 2010).

Table. 1. Workshop List

Year	Sub-Group	Workshop	Date
1	#2	Strawberry Workshop: Preparing for the New Season	8.02.07
1	#2	Strawberry Workshop: Nutrient and Irrigation Management	9.20.07
1	#2	Warm-season Vegetables –Efficient Production and Marketing	9.20.07
1	#1	Basic Nitrogen Principals Field Day	11.06.07
1	#3	Strawberry Field Day	4.09.08
2	#3	Irrigation and Nutrient Management	9.09.08
2	#1	Basic Nitrogen Principals Field Day	9.19.08
2	#3	Nitrate and Nutrient Interconnections: A Water Quality Symposium	11.06.08
2	#2	Production of Strawberries and Vegetables on the Central Coast	6.10.09
3	#1	Strawberry Production in Santa Maria	8.27.09
3	#3	Strawberry Field Day: Nitrogen Management Tools	9.09.09
3	#1	Strawberry Cutback in August for Harvest in November and December	11.19.09

Table 2. Soil Fertilizer and Nutrient Management Field Trials

Demonstration Site Trial	Trial Summary	Results
Fertilizer management for conventional strawberries	The purpose of the trial was to determine the optimal amount of preplant and midseason nitrogen fertilizer applications for conventional strawberries. Albion variety was studied at 3 different rates of preplant fertilizer application and 3 different rates of midseason fertilizer injections. A total of 60 plots were tested.	The CRCD conducted a survey of 29 growers from the three sub-groups. Typical pre-plant fertilizer application was found to be 112 lbs N/ac. This trial used rates of 0, 74, and 138 lbs. N/ac. From the survey, typical seasonal in-season fertilizer application was found to be 88 lbs. N/ac. This trial used weekly rates of 2.5, 5, and 10 lbs. N/ac. Results show that growers can, under similar crop and weather conditions, use 74 lbs. N preplant and 2.5 lbs. N/ac. weekly. Even for a season extending 30 weeks, this is an average reduction of 38 lbs. N/ac preplant and 13 lbs. N/ac in-season for a total reduction of 51 lbs. N/ac with no significant difference in marketable yield.
Fertilizer management for organic strawberries	The purpose of the trial was to determine the optimal type and amount of midseason nitrogen fertilizer applications for organic strawberries. Albion variety was studied at 3 different rates of midseason fertilizer injections. A total of 60 plots were tested.	Plant N uptake and residual soil levels were not significantly different depending on the type of organic fertilizer that was used: True Organic (4N-1.8P-1.2K), Neptune's Harvest (4N-0.9P-0.6K), and Phytamin 434 (4N-1.35P-2.4K). Plant N uptake and residual soil levels were not significantly different depending on the amount of organic fertilizer that was used. Rates tested were 6, 12, and 18 lbs. N/ac per week. The lowest rate of 6 lbs. N/ac is 312 less lbs. N/ac. less per 26-week season than the high rate that is more typical.

Biochar soil amendment in strawberry beds	The purpose of the trial was to investigate the potential of a new biological soil amendment, Biochar. This soil amendment is purported to increase soil organic material, prevent nitrate leaching, and sequester carbon in soils. A total of 5 different rates of Biochar material incorporation were tested on a total of 20 plots.	This was our first experiment with Biochar. Biochar did not significantly increase yield. Biochar at high rates may significantly reduce yield. Biochar at low rates may prove beneficial. Further research is necessary.
Strawberry transplant irrigation - sprinkler vs. drip	The purpose of the trial was to determine if establishment of strawberry transplants could be made with drip irrigation rather than traditional sprinkler irrigation that uses significantly more water. The resulting soil salinity, presence and severity of disease, and plant establishment were studied. Differences in plant survival, soil salinity (EC), and early yield results will be compared.	Drip irrigation proved to not cause reductions in yield when drip tape was placed at the surface, rather than buried to a 3" depth as is typical for in-season irrigation. More transplants died but the hardier plants that survived compensated in high production rates and quicker growth, likely due to warmer, drier conditions. Where low EC can be maintained, drip for transplant establishment seems promising. Additional research is required.
Strawberry cutback fertilizer and timing	The purpose of the trial was to determine the optimal cutback date and midseason fertilizer application rate for conventional cutback strawberries. A total of 3 cutback dates and 2 different rates of midseason fertilizer injections were being studied for 1 strawberry variety. A total of 24 plots were tested.	Differences in marketable yield of conventional strawberries were found to be significant based on cutback date. If future trials have consistent results, we can make local cutback timing recommendations for Albion. There were no significant differences in yield between fertilizer rates. The lower rate could be used.
Strawberry deficit irrigation	This trial was set up in the organic field to compare three different irrigation rates. We irrigated with drip tape 80 and 65 percent of the volume of water the grower used. Weekly soil measurements for nitrate and EC were obtained. Soil moisture was monitored using tensiometers and a Watermark soil moisture sensor. Twice weekly yield data was collected.	Differences in marketable yield of organic strawberries were found to be significant based on the run time of each irrigation. Preliminary results conclude that though there were no significant differences in yield, there were significant reductions in berry size. Since berries are sold in 'clamshell' containers, larger berries, with fewer berries per container, are desirable. This grower uses an on-site weather station to help schedule irrigations. Irrigation reduction may not be feasible for this grower. Using what we learned from this trial, we can make irrigation recommendations for other growers who are not currently using irrigation scheduling tools.
Nitrogen in vegetable crops	The purpose of this trial was to determine local nitrogen uptake curves for Napa cabbage and iceberg lettuce and to see if the Soil Nitrate Quick Test could be used to trigger side-dress fertilizer applications.	Traditional N fertilization rates for Napa cabbage during the May to July period is approximately 148 lb N per acre. Results from this field trial suggest that rates can be cut by approximately 44% by eliminating pre-plant N application using the Soil Nitrate Quick Test and 20 ppm as a trigger point for N

		application. Traditional N fertilization rates for lettuce during the April to June period is approximately 118 lb N per acre. Results from this field trial suggest that rates can be cut by approximately 54% by eliminating pre-plant N application using the Soil Nitrate Quick Test and 20 ppm as a trigger point for N application.

G. RESULTS

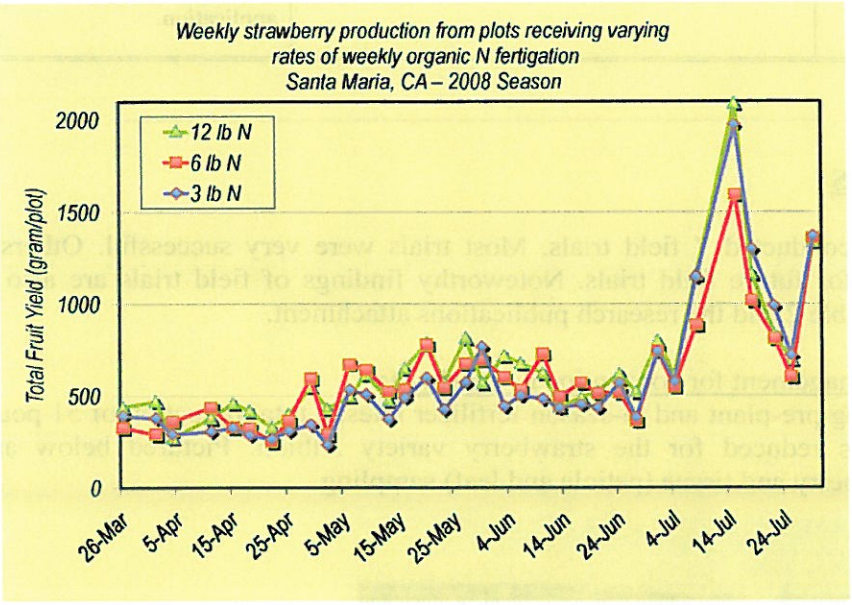
The CRCD conducted 7 field trials. Most trials were very successful. Others have provided information for future field trials. Noteworthy findings of field trials are also summarized in Section F. Table 2 and the research publications attachment.

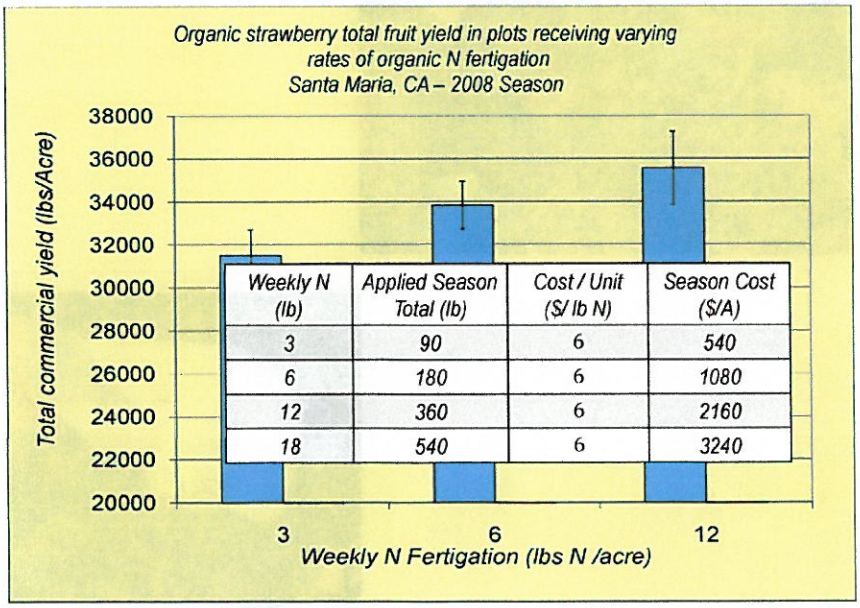
Fertilizer management for conventional strawberries

By fine-tuning pre-plant and in-season fertilizer rates, a total reduction of 51 pounds of nitrogen per acre was reduced for the strawberry variety Albion. Pictured below are CRCD staff performing berry and tissue (petiole and leaf) sampling.

Fertilizer management for organic strawberries

All tested organic fertilizer formulations tested worked equally well. The lowest in-season fertilizer rate did not significantly reduce yield. This rate was three times less than the highest rate. Using the low rate, a grower could save 312 pounds of nitrogen per acre. per season than by using the higher, more typical rate. Though the crop yield was slightly lower, the cost savings was greater due to lower fertilizer costs.





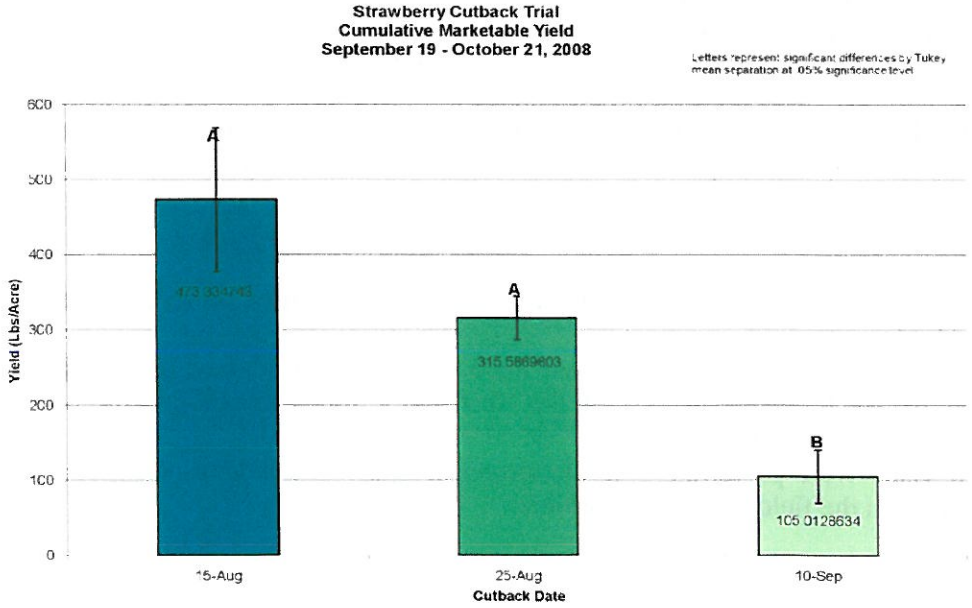
Weekly N (lb)	Applied Season Total (lb)	Cost / Unit ($/ lb N)	Season Cost ($/A)
3	90	6	540
6	180	6	1080
12	360	6	2160
18	540	6	3240

Strawberry transplant irrigation -sprinkler verses drip

Yields in fields using drip irrigation for strawberry transplant establishment were not significantly lower than fields using sprinkler irrigation for transplant establishment. A reduction of 40% irrigation water is possible with drastically less run-off. Pictured below is sprinkler irrigated runoff.

Strawberry cutback fertilizer and timing

Local cutback timing recommendations for Albion could be made if we achieve consistent results in future trials. The lowest fertilizer rate showed no significant difference in marketable yield.



Nitrogen in vegetable crops

Results from this field trial suggest that nitrogen rates for Napa cabbage can be cut by approximately 44% and iceberg lettuce (pictured below) by 54% by eliminating pre-plant nitrogen application using the Soil Nitrate Quick Test and 20 ppm as a trigger point for nitrogen application. The cooperating grower has cut his fertilizer use by over 50%. Using what we learned from this trial, we are currently conducting a similar trial for romaine lettuce.

Grower Survey

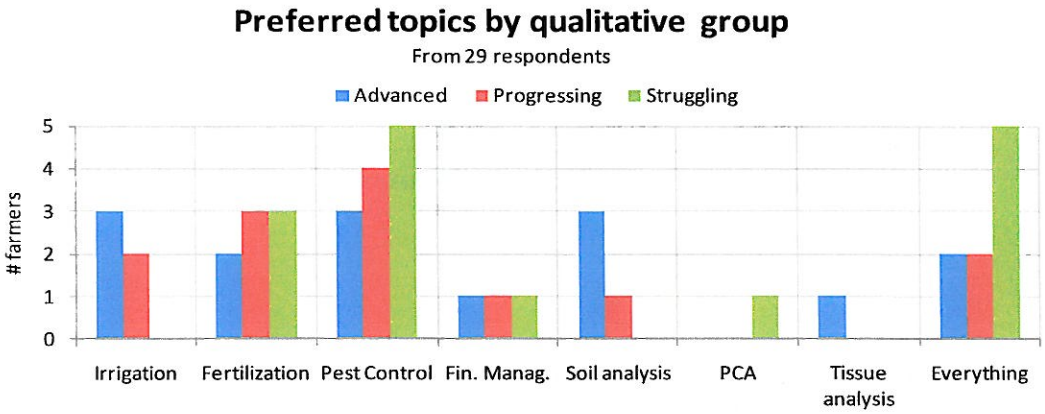
This survey was conducted with all three Spanish-speaking grower groups, identified as 'struggling' (sub-group 1), 'progressing' (sub-group 2), and 'advanced' (sub-group 3). In order to be objective, we hired on an outside consultant to conduct the survey.

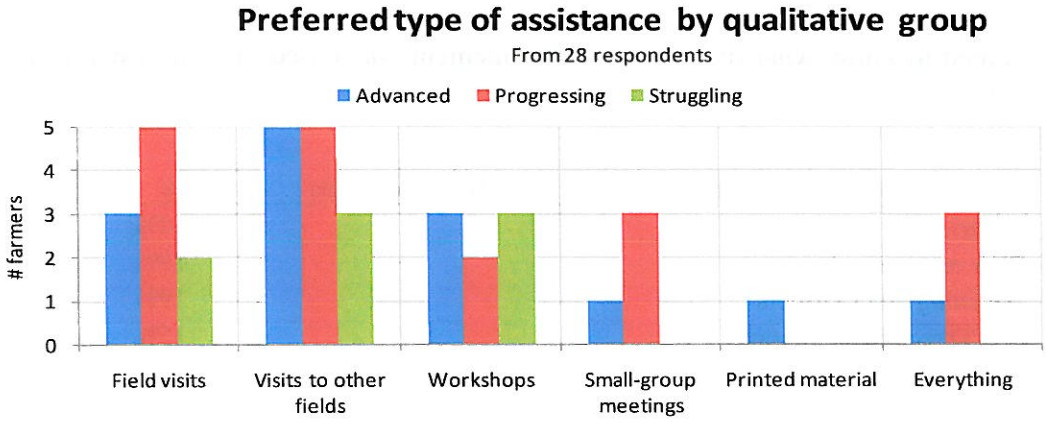
Important findings for CRCD outreach to these groups include the types of information these groups hope to obtain, how they would like it to be disseminated, and how they would like to be notified of trainings.

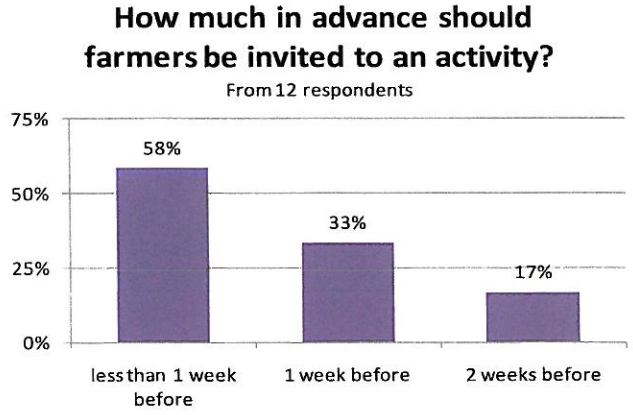
Findings:

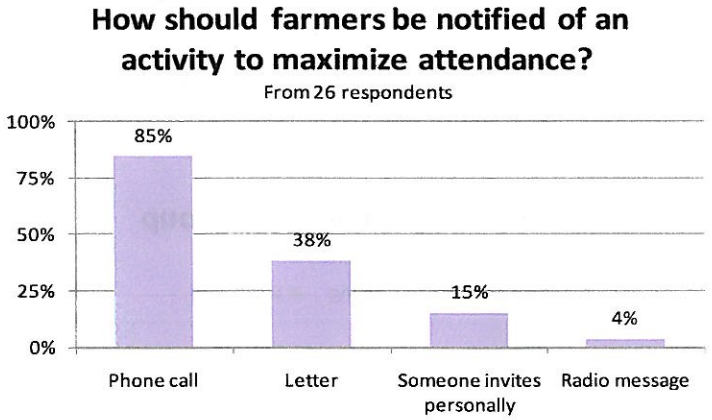
- Include pest control information in our fertilizer and irrigation trainings to achieve greater attendance.
- While sub-group 1 has the greatest need of information, they do not prefer written material. We transferred some of the 'fact sheet' focus to sub-groups 2 and 3 in the development of three bulletins.
- Field visits were preferred over classroom settings. We held trainings, or portions of trainings, in the field whenever possible.

- Phone calls made a few days prior to a workshop was the preferred notification method. We did not disseminate flyers for all workshops. Instead, we asked our bilingual staff to make calls a few days prior to the workshop. This allowed us to better establish rapport and answer questions the grower might have about the workshop.









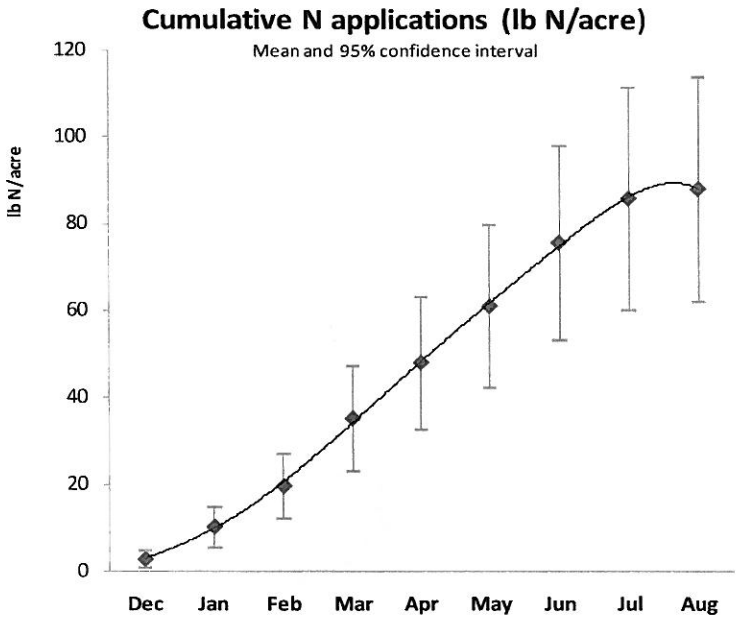
We wanted to determine what nutrient and irrigation management practices growers needed the most help with and what they might be receptive to.

Nutrient Management:

We wanted to know what their nutrient management was based on and how much was being applied.

Table 3. Factors considered for pre-plant fertilization decisions	#	%
Experience	13	50%
PCA recommendations	5	19%
Watching other farmers	5	19%
CRCD recommendations	4	15%
Tradition	3	12%
Soil analysis CRCD	3	12%
Soil analysis company	3	12%
Land preparators	3	12%
Own Soil analysis	3	12%
Own experiments	3	12%

From a total of 26 respondents



Irrigation Management:

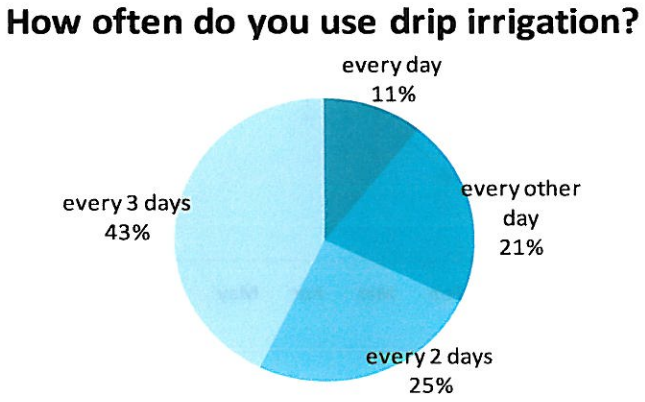
We wanted to know the reasons that growers use sprinkler irrigation for strawberry establishment so we could know what criteria to meet when attempting to use drip irrigation.

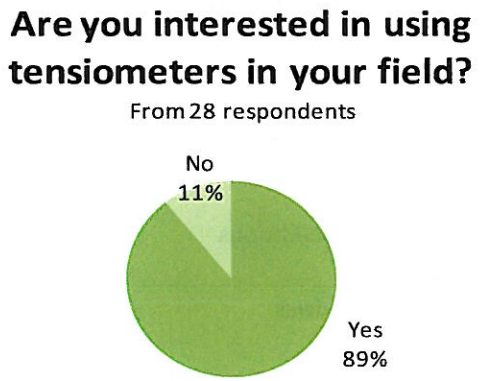
Table 4. Reasons that farmers use sprinklers after planting.

Plant establishment	8	57%
Leaching salts	5	36%
According to weather conditions	3	21%
Land Compactation	1	7%

From a total of 14 respondents

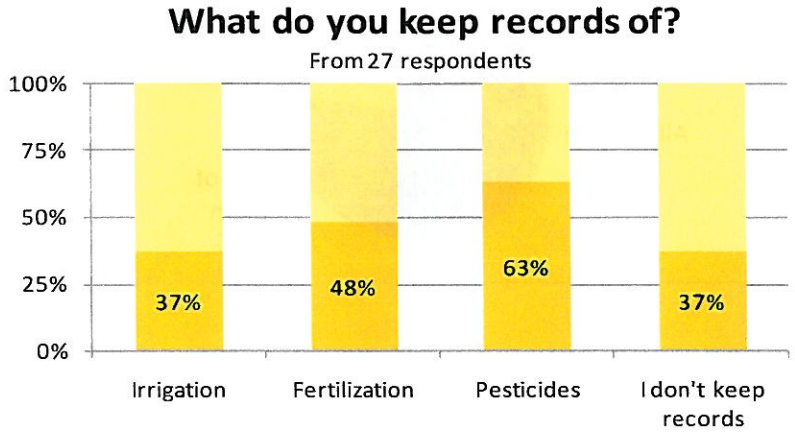
We discovered that there was a need and an interest in using more tools for irrigation scheduling.





Recordkeeping:

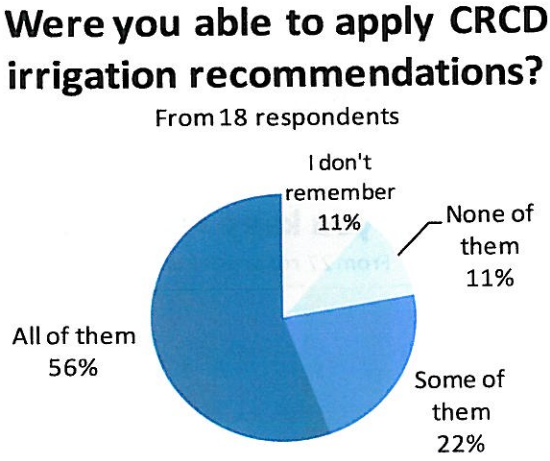
Little or no recordkeeping was taking place so we developed recordkeeping forms in Spanish.



We also wanted to know if growers were responding to our recommendations. The Soil Nitrate Quick Test and Irrigation Mobile Lab were both well received.

26 farmers (90% from 29 respondents) declared to know the Soil Nitrate Quick Test. 24 farmers (83%) have tried the soil NQT in their fields, although 17 (59%) keep using it.

Pictured below is a grower using the Soil Nitrate Quick Test.


Were you able to apply CRCD irrigation recommendations?
From 18 respondents
I don't remember 11%
None of them 11%
Some of them 22%
All of them 56%

H. DISCUSSION/CONCLUSION

Grower Survey

The grower survey was an excellent tool to help us understand the challenges and needs of each subgroup in better detail. Some of the information we had learned from previous interactions with growers, but not in nearly as much depth. Some of it surprised us and has helped guide CRCD outreach, workshop design, and research for this and other projects.

Workshops

Twelve workshops were conducted for all sub-groups, for strawberry and vegetable growers, with an average of 21 growers in attendance at each workshop.

Field Visits

Goals set for sub-group 1, year 1, Task 1.5 and sub-group 2, year 2, Task 1.4 were follow-up field visits for 25% of workshop attendees; 12 for sub-group 1 and 25 for sub-group 2 respectively. These goals were exceeded. The nature and extent of the assistance provided varied depending on the needs of the grower. Follow-up technical assistance consisted of Soil Nitrate Quick Test demonstrations, irrigation evaluations, and assisting Spanish-speaking growers to sign up for EQIP contracts with NRCS. Growers have reported that the individual technical assistance provided has been extremely helpful in mobilizing the appropriate resources to address their technical concerns.

Printed Materials: Fact Sheet, Bulletins, and Recordkeeping Forms

The Spanish-language fact sheet assists sub-group 1 growers to perform the Soil Nitrate Quick Test. The three bulletins were distributed to 200 sub-group 2 and 3 growers. Recordkeeping forms were discussed and distributed at the Strawberry Field Day on September 9, 2009 for sub-group 3 growers.

Research Trials

By partnering with local UC researchers, we were able to conduct multiple field trials, all of which were directly related to this project. The results are promising. The objectives of individual experiments were certainly met, but we must account for diverse growing situations and the influence of different weather conditions. We continue to replicate some of the nutrient and irrigation management experiments in various soil types over multiple seasons. Because we participated in so many trials, and many are continuing, we have not yet published findings. They will eventually be submitted to technical journals such as HortTechnology. In the meantime, the research continues to be shared at grower workshops by CRCD technical staff and UC cooperators.

I. PROJECT EVALUATION

CRCD field technicians have visited 74 different farmers to assist growers with soil sampling, interpreting the soil analyses reports and in performing the Soil Nitrate Quick Test. 55 were strawberry growers, 9 were vegetable growers, 14 were vineyard and orchard growers; all three sub-groups were represented.

The CRCD has set-up 'farm-off' field trials with 5 Spanish-speaking growers to evaluate irrigation distribution uniformity, soil moisture content, soil amendments, soil nitrate and soil salinity. The trials have been an excellent tool to help the farmers monitor their crop production as well as keeping track of inputs through recordkeeping. Since the CRCD grower survey determined that growers are more apt to base fertilizer and irrigation decisions on experience and observing other farmers that from technical assistance organizations, these field trials are valuable.

The CRCD mobile irrigation lab has conducted irrigation evaluations on 11 different farms covering a total of 821 acres.

CRCD has installed soil moisture monitoring equipment 'tensiometers' in three sugar-snap pea fields and two strawberry fields. Technical staff assisted the farmers in collecting and interpreting the soil moisture data to be used to assist with irrigation scheduling.

The CRCD assisted 14 Spanish-speaking growers to sign up for Environmental Quality Incentives Program (EQIP) contracts with NRCS. Each of these contracts includes cost-share funding and irrigation and nutrient management technical assistance. The growers participating in this program qualify for the EQIP Socially Disadvantaged Farmer or Rancher designation.

CRCD staff has continued to build its capacity to best serve Spanish-speaking growers in the Santa Maria Valley. These capabilities will continue to be used to serve growers in the form of workshops, technical assistance, and educational material development and distribution. CRCD will continue to interface with NRCS and UCCE to provide technical assistance.

This project provided an excellent opportunity to extend research findings to growers through outreach and technical assistance so that research findings can be more widely utilized by growers. We thank the Fertilizer Research and Education Program for supporting the CRCD's work with underrepresented and small-acreage growers.

J. OUTREACH ACTIVITIES SUMMARY

Table 5. Workshops for Sub-Group 1

Workshop	Workshop Summary
Date: 11.06.07 Location: Santa Maria, Santa Barbara County **"Basic Nitrogen Principals Field Day"** Attendees: 12 Growers	Tom Lockhart, Monica Barricarte, Hugh Smith, and Mark Gaskell, conducted an informal outreach meeting. Gaskell discussed market trends and optimal planting schedules for squash, beans and tomatillos. These crops can act as nitrogen trap crops by utilizing/scavenging nutrients left by the previous crop. Barricarte discussed the irrigation mobile lab evaluations the lab has conducted for Spanish speaking farmers. Lockhart discussed fertilizer management and offered to train the farmers to perform the Soil Nitrate Quick Test to predict crop nitrogen needs. Smith used a white board to write down the concerns the farmers had regarding irrigation, fertilizer, and pest management. This was a useful problem solving session that helped us better identify the concerns and needs of this sub-group for future trainings.
Date: 9.19.08 Location: Santa Maria, Santa Barbara County **"Basic Nitrogen Principals Field Day"** Attendees: 8 Growers	Adriana Morales, Maria Paz Santibanez and Claire Wineman of the CRCD conducted this event with farmers growing for Red-Blossom Strawberries. Pre-plant fertilizer rates and timing of mid-season nitrogen injections, as well as utilizing nitrogen in irrigation water were the topics of this meeting. Results from the slow-release fertilizer trials conducted in 2007 and 2008 were presented. Eight farmers attended and each of them reported that they were going to use less pre-plant fertilizer than the previous year and that they were going to rely more on mid-season injections for supplying nitrogen. This was poorly attended but successful in that all participants indicated adoption of fertilizer management practices.
Date: 8.27.09 Location: Santa Maria, Santa Barbara County **"Strawberry Production in Santa Maria"** Attendees: 18 Growers	Kevin Peterson, CRCD Mobile Irrigation Lab leader, introduced growers to Mobile Lab services. Frank Zalom, Extension Entomologist, presented on insect control. Surendra Dara, Farm Advisor, presented on lygus monitoring. Mark Gaskell, Farm Advisor, presented preliminary results of strawberry nutrient and irrigation management field trials. The afternoon session was held at the organic fertilizer demonstration site. We learned from our previous interactions with this sub-group. By including pest management information, we drew more growers and provided more holistic information. We were still able to focus on fertilizer management, using the field trial to demonstrate the ability to reduce pre-plant and in-season fertilizer use.
Date: 11.19.09 Location: Santa Maria, Santa Barbara County **"Strawberry Cutback in August for Harvest in November and December"** Attendees: 11 Growers	Guest speakers from UC Cooperative Extension discussed experiences with cutting back strawberries in August for harvest in November and December. Topics included appropriate varieties for cutbacks, fertilization, and irrigation. This workshop was presented in Spanish at the cutback field demonstration site. It was good that we delayed this workshop so growers could visit the demonstration site at mid-harvest.

Table 6. Workshops for Sub-Group 2

Workshop	**Workshop Summary**
Date: 8.02.07 Location: **"Strawberry Workshop: Preparing for the New Season"** Attendees: 31 Growers	Strawberry grower Dave Peck made a presentation on crucial aspects of planting and growing a new variety "Albion". UC Specialist Curt Gaines presented information on evaluation of Nursery Quality Control, including transplant quality, handling, chilling requirements and scheduling. UCCE Farm Advisor Hugh Smith, and Cachuma RCD Irrigation Specialist conducted a Strawberry Production Field School on growing Albion. Albion accounts for 58% of berry production in Santa Maria. This workshop was effective because by providing information specific to Albion, we were able to match fertilizer recommendations to the growth curve of this variety.
Date: 9.20.07 Location: Santa Maria, Santa Barbara County **"Strawberry Workshop: Nutrient and Irrigation Management"** Attendees: 23 Growers	UCCE Farm Advisor Mark Gaskell discussed fertilizer application practices for strawberries, including the use of slow release fertilizers. Adriana Morales of Cachuma RCD made presentations on the importance of soil analysis, interpretation of lab results and using the Soil Nitrate Quick Test (SNQT) for midseason fertilizer application timing. UCCE Farm Advisor Mark Bolda presented information on strawberry leaf analysis for prediction of fertilizer requirements. Lunch was held at a fertilizer demonstration site. The growers were interested in the SNQT and getting growers to use tools to determine fertilizer need it crucial, so this was successful. We followed-up with visits to demonstrate the SQNT.
Date: 9.20.07 Location: Santa Maria, Santa Barbara County **"Warm-season Vegetables – Efficient Production and Marketing"** Attendees: 10 Growers	Afternoon workshop. Monica Barricarte made a presentation of what soil, irrigation and nutrient management services are available through Cachuma RCD. Mark Gaskell presented charts showing market prices for zucchini, green beans and tomatillos from local terminal markets for the past five years. The farmers discussed with Gaskell the timing of planting and harvesting and the opportunity windows for local conditions in relation to historic prices for these three vegetables. Hugh Smith led a discussion for these three crops on insect pests and available control methods. The population of Spanish-speaking vegetable growers is vastly smaller than Spanish-speaking strawberry growers in this area. We were able to reach ten growers to provide them with practical information and familiarize them about our services.
Date: 6.10.09 Location: Santa Maria, Santa Barbara County **"Production of Strawberries and Vegetables on the Central Coast"** Attendees: 34 Growers (25 Strawberry; 9 Vegetable)	Mark Battony, Farm Advisor, spoke about irrigation management. Mark Gaskell, Farm Advisor, spoke about fertilizer management. Mark Bolda, Farm Advisor, spoke about plant nutrition and efficient decision-making. Surendra Dara, Farm Advisor, spoke about IPM for the two-spotted spider mite. The workshop ended with a tour of the conventional fertilizer management field demonstration site. CRCD staff demonstrated the Soil Nitrate Quick Test. This workshop wrapped up our trainings for sub-group two and drew some growers from the other sub-groups.

Table 7. Workshops for Sub-Group 3

Workshop	**Workshop Summary**
Date: 4.09.08 Location: Santa Maria, Santa Barbara County **"Strawberry Field Day"** Attendees: 39 Growers	Mark Bolda and Mark Gaskell, UCCE Strawberry Farm Advisors, discussed nutrient monitoring for in-season applications. Steve Fennimore, UC Weed Specialist, discussed weed management. Steve Koike, UC Farm Advisor, and two UC Specialists discussed pest and disease management. The workshop ended with tours of two UCCE field trials for nutrient and weed management. We were successful in obtaining UCCE Advisors and Specialists from Davis to provide information suitable to sub-group three. This workshop was well-attended and there were many questions for the UC researchers.
Date: 9.09.08 Location: Morro Bay, San Luis Obispo County **"Irrigation and Nutrient Management "** Attendees: 24 Growers	Tim Hartz, UCCE Vegetable Crops Specialist, presented information on nutrient budgeting in cool-season vegetables. John Letey, Center for Water Resources, presented the Hazard Index for evaluating the nitrate leaching potential for irrigated cropland. Kevin Peterson, leader of the RCD mobile irrigation lab, gave a demonstration of a Distribution Uniformity (DU) test. Stuart Styles, Irrigation Training and Research Center Cal Poly, discussed how to improve irrigation efficiency. Dr. Styles has also been conducting 'Sprinkler vs. Drip' research. It was good to have speakers from separate entities in agreement about how growers might fine-tune their management. Even the most diligent operations can often make improvements to their DU and irrigation scheduling. .
Date: 11.06.08 Location: Santa Maria, Santa Barbara County **"Nitrate and Nutrient Interconnections: A Water Quality Symposium"** Attendees: 30 Growers	Eric Ellison, Simplot, discussed new technologies for efficiency of phosphate fertilizers. Dave Goodrich, Western Farm Service, discussed use of controlled release fertilizers, Tim Hartz, UCCE Vegetable Crops Specialist, presented information on nutrient budgeting in cool-season vegetables, LaoSheng Wu, Center for Water Resources, presented the Hazard Index for evaluating the nitrate leaching potential for irrigated cropland. This was an opportunity for us to reach more vegetable growers. It was also our first workshop to address phosphate fertilizer. It was well-attended.
Date: 9.09.09 Location: Santa Maria, Santa Barbara County **"Strawberry Field Day: Nitrogen Management Tools"** Attendees: 13 Growers	CRCD staff presented the afternoon session at the cutback demonstration site. The emphasis was on presenting "Farm-off" demonstration field trial results to farm managers. Results on timing of cutback and second year berries and fine-tuning pre-plant fertilizer application and mid-season nitrogen management were presented. Other topics included irrigation management, leaching fractions, demonstration of the Soil Nitrate Quick Test for CAN17 injections, synchronization of irrigation and fertilizer applications, and recordkeeping. We built on previously dispersed information. This was our opportunity to walk sub-group #3 growers through the recordkeeping forms so we would have liked better attendance.